

Appl. No. 10/711,015  
Amdt. dated February 14, 2006  
Reply to Office action of November 16, 2005

**Amendments to the Claims:**

1. (Currently amended) A copper damascene process, comprising:  
forming a dielectric layer overlying a substrate;  
etching a damascene opening into said dielectric layer;  
5 filling said damascene opening with copper or copper alloy;  
treating a surface of said copper or copper alloy with hydrogen-containing plasma;  
reacting said treated surface of said copper or copper alloy ~~with trimethylsilane or~~  
~~tertramethylsilane~~—under plasma enhanced chemical vapor deposition (PECVD)  
conditions comprising simultaneously supplying trimethylsilane or tertramethylsilane and  
10 initiating plasma to make said trimethylsilane or tertramethylsilane react with said treated  
surface of said copper or copper alloy; and  
in-situ depositing, by PECVD, a silicon carbide layer capping on said copper or  
copper alloy.
- 15 2. (Original) The copper damascene process according to claim 1 further comprising:  
lining said damascene opening with a diffusion barrier layer;  
forming a seed layer on said diffusion barrier layer; and  
forming said copper or copper alloy on said seed layer.
- 20 3. (Original) The copper damascene process according to claim 1 wherein said  
damascene opening comprises a contact or via hole in communication with a trench  
opening.
4. (Original) The copper damascene process according to claim 1 wherein the step of  
25 reacting said treated surface of said copper or copper alloy with trimethylsilane or  
tertramethylsilane comprises following processing parameters: a trimethylsilane (or  
tertramethylsilane) gas flow in the range of 100 to 5000 sccm; a process temperature in  
the range of 300°C to 450°C; and a reaction duration in the range of 0.1 seconds to 30

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seconds.

5. (Currently amended) A copper damascene process, comprising:  
forming a dielectric layer overlying a substrate;  
5 etching a damascene opening into said dielectric layer;  
filling said damascene opening with copper or copper alloy;  
treating a surface of said copper or copper alloy with hydrogen-containing plasma;  
reacting said treated surface of said copper or copper alloy ~~with trimethylsilane or~~  
~~tertramethylsilane~~ under plasma enhanced chemical vapor deposition (PECVD)  
10 conditions comprising simultaneously supplying trimethylsilane or tertramethylsilane and  
initiating plasma to make said trimethylsilane or tertramethylsilane react with said treated  
surface of said copper or copper alloy; and  
in-situ depositing, by PECVD, a silicon carbide layer capping on said copper or  
copper alloy, said silicon carbide layer being treated with in-situ ammonia plasma to  
15 remove contained oxygen of the deposited layer.
6. (Original) The copper damascene process according to claim 5 further comprising:  
lining said damascene opening with a diffusion barrier layer;  
forming a seed layer on said diffusion barrier layer; and  
20 forming said copper or copper alloy on said seed layer.
7. (Original) The copper damascene process according to claim 5 wherein said  
damascene opening comprises a contact or via hole in communication with a trench  
opening.  
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8. (Original) The copper damascene process according to claim 5 wherein the step of  
reacting said treated surface of said copper or copper alloy with trimethylsilane or  
tertramethylsilane comprises following processing parameters: a trimethylsilane (or

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tertramethylsilane) gas flow in the range of 100 to 5000 sccm; a process temperature in the range of 300°C to 450°C; and a reaction duration in the range of 0.1 seconds to 30 seconds.

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